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ABSTRACT

In the first section of this paper, the theory behind the use of educational technology in New York State is discussed: that the major contribution of technology to education should be to help achieve individualized instruction and help students become self-motivating, self-directing independent learners. Current activities in the use of educational technology, such as the state of educational television and a Technology Demonstration Program, are described (with additional information in this area appended) in a second section. Finally, the conclusions reached at a New York State Education Department Conference on instructional uses of the computer are presented, the major conclusion being that a large and carefully coordinated development effort must be undertaken if the potential of the technology is to be realized. (SP)

# EDUCATIONAL TECHNOLOGY IN NEW YORK STATE - Theory, Practice, and the Future

## I. Theory Ital

by Norman D. Kurland*

In 1963 I wrote the following statement about educational technology:

> Instructional technology provides for the first time the potentiality for truly individualized conditions of learning for each student while affecting the efficiencies of instruction that can be achieved by mass education. With the new technology what is done well once can be multiplied a thousand-fold. The economies so realized can release resources to do for every child what once could be done only for a few. Thus education can become more effective even as it becomes more available. We can have both quantity and quality, though the latter will be much harder to achieve than the former.

That statement reflected reasonably well the hopes that many had at the time concerning the impact of technology on education. Needless to say, five years later we are a long way from realizing those glowing expectations. If we take New York State as a whole and take into account the time spent in school by all pupils, we would have to say that instructional technology plays a very small role. If all of the technology now being employed were to be eliminated instruction would continue with very little interruption. To be sure, teachers would have to fill in the hours taken up by films, television and recording, but not much of significant educational value would have been lost.

Instructional technology is largely supplementary to the two primary media of instruction: the textbook and the teacher. Eliminate either of these and the educational system would be transformed, eliminate all of technology and education would go on with hardly a missed lesson. In other words, instructional technology has not been made an integral part of the life of the classroom in the way it has become in life outside the classroom.



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Why has this been the case?

In the first place, five years is a very brief time in which to see much change in a system as complex and structured as education. The rapidity with which technology has transformed some other areas of our lives has led us to expect similar transformations everywhere. We must note, however, that technology has worked best where things are to be changed and least well where people have to change. Thus we have produced magnificent automobiles and highways but have not been able to get people to use them safely.

One reason is the low investment in the equipment for instructional technology.

According to a recent publication of the Division of Educational Communications of the New York State Education Department, Percentile Ranking of Educational Communications Programs, the median expenditure for educational communications (including rentals, subscriptions and purchases of materials, equipment and services, but excluding personnel and major installations) is $2.38 per pupil or under $60 a year for a class of 25. The advanced standard adopted by the State calls for a per pupil expenditure of $31.00. No district in the State reaches this level nor the basic standard of $20.82. The closest are districts expending $12.50 per pupil.

The report notes that "only a small percentage of school districts meet the basic and advanced DAVI - N.Y.Standards" - the average percentages being 6.2 and 1.2 respectively.

For example, no school system can boast of a television receiver for every teacher (the advanced standard), although nearly every child comes from a home with at least one receiver. The median level in the State is one receiver to 27 teachers. Film and slide projectors, tape recorders,

record players and overhead projectors are available in nearly every school building but seldom in sufficient quantity to encourage regular and sustained classroom use. There is evidence from a project in Buffalo, however, that when a school is provided with sufficient equipment and a large library of films, the use of instructional films goes up greatly.

The advanced and basic standards and State median for the above items are as follows:

| Item | Teachers Per Item | | |
|---|---|---|---|
| | Advanced | Basic | Median |
| 16 mm Projector | 5 | 10 | 11.7 |
| Slide and Filmstrip Projectors | 1 | 3 | 6.75 |
| Overhead Projector | 1 | 4 | 12 |
| Audiotape Recorders (elementary level) | 2 | 5 | 11 |
| Record Players (elementary level) | 1 | 1 (K-3) 1 per grade 4 - 6 | |

to electric toothbrushes of anywhere from $2,000 to $5,000. A classroom so well endowed would be considered richly equipped.

Why the contrast? Clearly neither the teacher nor the taxpayer has yet seen sufficient value in classroom technological aids to demand or to grant them in great quantity. In the home the advantage of the automatic washer is easily perceived. Vast sums have been expended to entice the housewife into using it and in making it easy for her to do so. Nothing comparable has been done for the classroom. Washing machine manufacturers quickly learned to reduce operating noise levels so that the washing machine could be tolerated even in a crowded apartment. Controls were simplified so that any woman could operate them without difficulty. In the classroom, the movie projector still operates at an undesirable noise level and is sufficiently complicated to deter many a teacher from using it.

It is, of course, not alone the lack of equipment that explains the low rate of use of instructional technology. If there were the need and the demand, the equipment would be there. The fault lies more with the entire functioning of the educational system today. This can best be seen by considering what the role of technology could be.

The major contribution of technology to education should be help to achieve individualized instruction.

Under present instructional arrangements individualization can never be more than a dream. In most school situations, classes are not homogeneous or small enough or teachers able enough to adjust adequately to individual differences. Every learner is handicapped in some way - the fast, by being held down to the pace of the slower, with the attendant boredom, frustration, and loss of powers not sufficiently exercised; the slow, by never quite mastering a subject before being forced to move along to the next topic; and the average - but there is no one average in everything! With technology we can come closer to insuring that the fast learner moves ahead at a pace adjusted to his capacity and that the slow learns thoroughly each lesson before he is allowed to move ahead, thus eliminating the perpetual frustration which must be a major obstacle to his educational achievement.

Differences in maturation rates may also more successfully be accommodated. Slow maturers now may be handicapped permanently by being tagged in their early school years as "dumb" and by failing to master fundamentals before they are moved along to more advanced materials. The new instruction would adjust to changing capacity for learning throughout the learner's educational career and thus try to assure that each one would achieve to the maximum of his capacity. Moreover, once programs are developed for learners of different capacities, it should become possible to understand the obstacles to learning and to develop more effective strategies for helping learners at all levels to learn more and better. It is even conceivable that the difficulty of some slow learners may derive from an inherent incapacity for manipulation of verbal symbols. Machines permit

the presentation of non-verbal stimuli-pictures, diagrams, or even things - and thus may make educable individuals who now appear to be uneducable.

Another intriguing development is the provision of sim ulated experiences as a means of approximating the conditions under which knowledge is applied. Suggestive work is going on in adapting the technique of the game to education. A number of experimental games have been developed and are baing tried out in school settings.

What of the role of the teacher in the new technology of education? It will certainly be greatly modified. Some teachers will be engaged primarily in the preparation of the instructional system in cooperation with other specialists. Such work will require a vast increase of understanding of both the learning process and the subject to be taught. Intelligence and imagination will be demanded as never before. When these qualities are present they will be available not just to the handful of students with whom even the best teachers now can work but to as many as the system cares to have them reach.

The primary role of the teacher will be to do what an automated system can never do - motivate, counsel, and lead students to those higher order functions which are the primary goals of education - to question, imagine, invent, appreciate and act. Instead of a purveyor of information, he will be the orchestrator of a rich array of resources - highly varied and diverse but brought by him into harmony with the needs of the individual student. Because he will be relieved of the burden of regular classes he will be able to devote more time to individual students and to his own studies.

When he meets students both he and they will be prepared together to move into intricate and challenging aspects of a subject. Although the

number of such group meetings will be many fewer than today, there will be ample opportunity for contact between student and teacher and such contact will take place only when there is a real educational value to be realized, not because of the lack of more efficient means of communication. The teacher - and professor - will then have time for her own study and the more intimate, informal contacts which are the most rewarding parts of education. Under such conditions the teacher can be what, at her best, she always has been - a model, a stimulator, guide, planner, and fellow searcher after truth, meaning, and value. In this way we may yet preserve that vital personal relationship between student and teacher which is so gravely threatened by the depersonalization of our society.

A final benefit of the large-scale introduction of technology into teaching is that it will provide a basis both for raising teachers' salaries to professional levels and for differentiating among teachers of differing abilities. The obvious increased "productivity" and level of professional competence of the teacher who directs a learning "system" and participates in the creation of effective learning materials will justify a reward more nearly commensurate with the training and ability required for the task. The effectiveness, too, of teachers with lesser abilities, working in a team with able leaders and using well-designed materials, will be greatly enhanced.

Lest there be any illusions about technology increasing the teacher-student ratio, let me state that I do not see this as a likely long-run result. The effect of well applied technology will be to improve instruction and alter the functions of teachers and their relations to pupils and each other. But the effect of improved instruction is almost always to put greater demands on the creative teacher. What we can hope for from the introduction of technology, then, is not a saving of manpower, but of "mindpower" and a level of educational achievement more nearly up to the needs of our culture.

What then will the school of the future be like? We can, I think, envision a time of universal individualized education when every person will be educated and no two will be educated alike. Teachers deeply committed to the art of teaching and thoroughly versed in the science of learning will have at their disposal a full panoply of learning materials to which they will direct each individual student in accordance with his needs, abilities and interests.

There will be no lockstep and indeed no common schedule. Each student will proceed at his own pace through a curriculum uniquely adjusted to his needs. He will have, through many media, access to the best teaching and the best information on each subject along his way. Intrinsic motivation (the kind that successfully drives the child and that the schools largely kill) will largely replace extrinsic as the student early discovers the power of knowledge and the joy of learning, and has opportunity to grow in directions which attract him. He will move smoothly and early from directed, highly structured learning situations to self-directed, unprestructured activities where the learner plays an active role in learning.

Let me stress this latter point, since too little attention is paid to it in many current discussions of the new technology in education. Too often it is suggested that the impact of the new technology will be to make the student even more passive than he now is. This, of course, may happen, but it is not inevitable. A major thrust of much current work is to discover ways of stimulating and helping the student to become a self-motivating and self-directing, independent learner. Surely for a world of change, this is one of the most important outcomes that education can promote. This does not, of course, mean that the "new" student would work only in splendid

isolation. To learn is to want to communicate, and contact with teachers, scholars and fellow students is an important source of stimulation and ideas. The sharing of ideas and insights would in part emerge as a spontaneous consequence of learning, in part be structured into the learning experiences where required for most effective learning. Fellow learners would come together with each other or with a teacher. Such encounters, while not occurring with the regularity of present classes, would be far richer experiences because of the level of readiness brought by the students.

Seminar and lecture rooms, laboratories, and other dacilities would be located much as they are today wherever convenient. They would be used, however, on varied schedules in accordance with the needs of individuals and groups.

For example, a student who needs a laboratory for work in biology might sign up for (or rent) space for five weeks, another might need to consult an English teacher for two hours to work out some difficulty in his writing. One teacher might be available in his office for consultation on a regular schedule; another might schedule a series of lecture or seminar meetings every Thursday afternnon at two.

If one seeks a current model of this school of the future it is best seen in the public library. To the library each user comes with his own demands, and each is more or less successfully accommodated, though no two persons are served quite alike. There are almost no age or grade divisions - adult & child may work side by side and even at times use the same materials. Each proceeds at his own pace toward his own goals. Moreover, the library never presumes that it must supply all the users' needs for information.

It does what it can do best and leaves to other agencies in the community portions of the task appropriate to them.

Now after this somewhat extended peering into the future, let me turn to a basic issue that must be confronted in considering the role of educational technology - the impact of the new technology of education on the individual. Will it transform him into a mere extension of the machine - mindful of the things needed to keep the social machine going; mindless about the things that make him human? Every technological development has been an extension of some human functioning. Whether man is mechanized or freed by them depends on how he uses them.

Here I note a peculiar thing in many of the discussions about the impact of technology in general and particularly about its impact in education. There is a tendency to assume that the conditions determining the character of the impact whether for good or ill are inherent either in the technology or the conditions of society and will work themselves out whatever anyone may do or say.

The counter view is that what we do can influence the outcome. The role of technology in education is now being invented. Its invention can be left largely to chance; it can be left to those businesses - the so-called "education industries" - which have a growing stake in the outcome and who will not be left out; or it can be done by educators working in consort with many other groups, especially those in the education industries. Together they can work out an understanding of what education in the future is to be. The result should not be pious manifestos about everyone's good intentions but institutional arrangements that can help insure that the new technology is infused with a fundamental orientation to human values.

II. Practice ital

A. Educational Television

The State's educational television network is the nation's largest system to connect independently owned and operated community television stations. It broadcasts on two channels simultaneously, giving each station a choice of three programs: two from the net, or a third of its own. The network is programmed entirely by the stations, but is administered and operated technically by the State University of New York. It was developed by the University and the Office of a General Services both working closely with the State Education Department and the stations. The broadcasts originate mainly from a Network Operations Center in Albany, although any station can originate programs for the other stations.

The network began its operation in October 1967. It links stations in Buffalo, Schenectady, Syracuse, Rochester, and New York. Binghamton and Watertown will be added soon. An eighth station in Nassau County will be developed later. The present five station network has a potential audience of 14.3 million people and serves more than 80% of the state's population.

A program committee of seven representatives (one for each station, plus two non-voting members from the university and education department) selects all programming for the network. Each station retains the option to broadcast any program or not, or record it for a future broadcast. Besides its weekday daytime schedule, the network broadcasts University of the Air courses on Saturday, and programs from N.E.T. and the Eastern Educational Network each evening including weekends. Some live programming connecting several stations in town meeting style is also planned.

A major source of educational material is the stations themselves and the State Department of Education, through its Bureau of Mass Communications. One of the Bureau's most important jobs is to supply copies of tapes to the network and to the 177 school systems, reaching an estimated 1.6 million public school

students. Duplication is supplied for the Ampex VR-660 and VR-7000 videotape recorders located in the schools. Most of these schools have recievedfinancial assistance for their recorders and closed circuit systems from a matching-funds program administered by the Bureau.

Tape copies (averaging 100 per week) are made from a library of more than 1500 programs, including many complete courses. The Bureau also makes available duplicates of some 8500 titles from its audio tape library on request and for the minimum cost of the audio tape raw stock. Duplicating of video tapes is done by replaying them on a quadruplex recorder, an Ampex VR-1200, or two Ampex VR-1100's for recording on nine helical scan VR-7000's and six VR-660's. Audio duplication uses an Ampex Model 3200 duplicator with two slave units. New York State's experience seems to indicate clearly that the availability of software in the form of usable content materials makes possible the systems approach to more learning opportunity.

New York's Operation Center in Albany uses the most modern transmission and studio equipment available. Videotape recording and playback is done on four high-band VR-2000 recorders, equipped for monochrome and color. In addition, four VR-660 and four VR-7000 helical scan recorders duplicate material for use by university campuses. For audio material, the network center has an Ampex PD-10 audio tape duplicator with three slave units. The two-channel color compatible microwave system connecting the stations allows origination from any station or from Albany.

At the university level, television will be playing an even larger role in the future. Ten of the four-year colleges, four university centers, and one two-year college are now planning extensive closed circuit television facilities. Presently, five of the colleges each have two Ampex VR-1200 recorders for local production, recording, and playback. A number of the colleges are also equipped with VR-660 and VR-7000 helical scan recorders.

B. Technology Demonstration Program

The New York State Education Department has initiated a Technology Demonstration Program. This program funded at $75,000 on a matching fund basis is designed to develop demonstration centers in instructional technology. The "mini-grants" between $1,000 and $10,000 go to programs which school districts wish to introduce into their instructional programs. A major criterion for awarding a grant is readiness to continue the program after the one year State grant ends. Having received a State grant a school district agrees to receive visitors, provide an annual report both written and audiovisual, and allow for State distribution rights for materials produced. Fifteen districts were funded in 1968-69. The projects ranged from dial-access systems to graphic communication centers. It is anticipated that this program will be a major step in assisting school districts in getting their technology program off the ground. The continuation of the program on the part of the school district after State support has been withdrawn and willingness to receive visitors and share information with the State and other school districts promises and impetus to instructional technology that has been lacking in the past.

Other current activities.

There are a number of current activities in New York State which are described further in the Appendix. They are:

A. The use of educational data processing

B. The rural educational center in Upstate New York

C. Computer-assisted instruction in New York City.

## III. Planning for the Future

Recently the New York State Education Department sponsored a conference on the instructional uses of the computer. Reports were presented by some fourteen universities and school systems within the State describing the ways they were using computers to aid instruction. Uses ranged from full-scale CAI operations of the kind described above in New York City to simple rental of time-sharing terminals to allow students to explore the problem solving capabilities of the computer. In general, all of the programs are in an early exploratory stage in which there is plenty of enthusiasm for the potential of computers but little firm evidence that they can change the quality of instruction significantly.

The conclusions reached are equally applicable to the entire field of educational technology. The major conclusion was that a large, carefully coordinated research and development effort must be undertaken if the potential of the technology is to be realized.

The conference heard that no such systematic planning was now occuring at the Federal level although reference was made to the possibility the Commission on Educational Technology might do something of this kind. If no national action is forthcoming, the conferees urged that the planning and coordination be undertaken by the State. The feeling was strongly expressed that unplanned, uncoordinated efforts must be avoided. Not only is this terribly wasteful, but a few unproductive or negative projects, particularly in a field where project costs run high, could kill all interest and support for years to come.

It was generally felt, therefore, that a major effort must be undertaken both to discover how to use computers effectively to improve education and to produce evidence of the relative value of the new technology in comparison with alternative approaches.

To do this it was recommended that the research and development effort in the field be much more carefully planned than it has been to date. Up to now there has been little systematic planning for development. Projects are undertaken with little or no relation to one another and the findings, if any, of one project are seldom used or followed up in others. To help prevent this situation it was felt that some agency in the Federal government or the State should work-out a research and development plan to guide the funding of projects and to provide all concerned with a common reference.

One suggested planning approach was the following:

1. Identify all significant "alternative futures", - that is, possible ways in which the technology may someday be utilized in education.

2. Obtain estimates of the probable dates when each "future" may become reality and judgments on the desirability of each possible future.

3. Determine the activities that must be undertaken to arrive at the most desired futures including how much effort is likely to be required, what the cost will be and in what sequence the activities should best be undertaken.

4. Assess the current status of research and development with respect to each activity and the agencies or individuals most competent to carry forward on next steps.

5. Estimate the costs of arriving at each desired future in specified time periods. This will provide and indication of the level of investment that will be required to arrive at a desired goal by any given date in the future.

6. For varied levels of expenditure during each of the next five years, determine what mixes of activities are possible and how much each "mix" will contribute to the movement toward desired futures. This will give a reasonable basis for determining how best to use limited funds.

7. On the basis of all of the preceding information, establish long and short range development goals and specify the sequence of activities that must be undertaken to achieve those goals.

8. In each funding period support projects that fit the development plan.

9. Assess progress annually and revise the plan as experience dictates.

These steps would be applicable not just to the development of computer applications but might even be more meaningful if done for the total area of automated or technological aids to instruction.

Some other conference conclusions that are relevant to the work of the Commission are the following:

1. The major problem in CAI development at the present is not equipment but the lack of adequate theories of instruction or readily applicable validated experience. Therefore, extensive research and careful development should be undertaken. Application of computers to instruction without such a foundation is not going to produce measurable results to support the advantage of computers over traditional methods.

2. The successful application of computers (or any other technology) to education requires total system redesign - another reason why careful planning and a large investment of money and time will be required.

3. The proper question is, not how can computers (or any other device) be used in education, but how can computers help improve the quality of education. One implication of this formulation is that computers should be utilized in ways that take maximum advantage of their unique capabilities, leaving to other devices and to people functions that they can perform better.

4. For the next few years Federal or State funds should not be used for direct "hands-on" experience for students or teachers. If schools or colleges wish to provide such experience with their own funds, encourage them to use relatively inexpensive available equipment such as computers being used for administrative purposes, time-sharing terminals, calculators, or very low cost simple computers.

5. Encourage development of both computer monitored instruction (CMI) where there is no direct student access to computers and computer assisted instruction (CAI) where there is interaction with the computer.

6. While some attention should be given to the application of computers to present curricular goals and methods of instruction, the main emphasis should be on the changing goals and methods that will be more appropriate for education in the computer age.

7. A major developmental objective should be increasing compatibility among computer systems so that instructional programming may be more readily exchanged among users.

8. Begin developing plans now for the utilization of computer systems that will in a few years make available very low cost services using languages and procedures that will require no specialized training. These plans should include familiarizing both laymen and professionals with the profound changes these developments will bring about.

9. One of the major obstacles to the development of CAI identified by many conferees is the high cost of telephone communication from computers to remote terminals. These costs reduce the potential use of large systems and thus may make overall costs prohibitive. It was strongly urged that efforts be made to obtain changes in the FCC tariffs for live usage or that alternative arrangements, such as communication satallites, be quickly developed.

A. Educational Data Processing

The number of districts receiving data processing services, either from their own installations or from Boards of Cooperative Educational Services (BOCES), has increased from 100 to 342 during the period between September 1962 and September 1966. In addition, recent data has indicated that many more districts will soon join the growing ranks of educational data processing users.

Although the use of data processing equipment has become widespread throughout the State's elementary and secondary school community, there has been very little interaction between data processing installations. This uncoordinated development of educational data systems, by both individual districts and BOCES, has resulted in a considerable amount of duplication of effort, since the record-keeping functions of the school districts are essentially similar. At the same time, it appears that the computer has become a status symbol to many school districts. In such cases, the computer has been procured more often as a means of raising the prestige of the district than as an aid to handling educational data.

Since the utilization of data processing equipment and techniques by the State's school districts and BOCES represents a sizable monetary investment (estimated at 6.5 million dollars for the 1967-68 school year), the State Education Department could not ignore this trend towards uncoordinated expansion. In addition, the Department, realizing its obligation to provide technical guidance to the State's school districts, resolved to improve its expertness in this new field of educational data processing. Due to the above factors, the State Education Department decided to hire a consulting firm, experienced in educational data processing technology, to prepare recommendations for the development of a master plan for educational data processing within the State.

The consulting firm, System Development Corporation, proposed the system configuration described below. The recommendations have been adopted by the State and requests for bids to install the first phase of the system have gone out.

1. Regional Centers

At the present time, twelve regional centers are considered adequate to meet the educational data processing needs of the State's elementary and secondary schools (excluding New York City). In addition to their normal regional center data processing activities, three of these twelve centers will have evaluation and training responsibilities. The regional centers will all provide the following data processing applications:

Student Subsystem
- Census
- Enrollment
- Attendance
- Grade reporting
- Permanent records
- Test scoring and analysis
- Student scheduling

| | |
|---|---|
| Personnel Subsystem | • Payroll<br>• Personnel records<br>• Staff directories<br>• Retirement<br>• Professional qualifications |
| Financial Subsystem | • Budget preparation<br>• Encumbrance accounting<br>• Accounts Payable<br>• Cost Accounting<br>• Purchasing |
| Facilities Subsystem | • Inventory Control<br>• Construction requirements<br>• Maintenance<br>• Transportation<br>• Library and text book accounting<br>• Cafeteria accounting |

Except for the three E/T centers, student scheduling will only be accomplished to the extent of preprocessing student requests and printing out the final schedule. The E/T centers will accomplish the actual class scheduling on their larger computers due to the internal storage requirements inherent in scheduling programs. It should also be noted that the applications listed as part of the above subsystems (packages) are not meant to be all inclusive and should be considered merely as representative of the kinds of applications that will be covered. The actual applications to be included in the system will be based upon user requirements.

2. Evaluation and Training Centers

In addition to providing the class assignments in scheduling, the E/T centers will provide other services which require the use of a bigger computer, such as certain sophisticated statistical analyses which might be requested by a district.

Besides accomplishing the activities stated above, the evaluation and training center will provide the following special functions and services:

a. Design and evaluate new educational data processing applications.

b. Evaluate new equipment and technological advancements in respect to the needs of the Statewide system.

c. Train school and center personnel in educational data processing activities.

d. Recommend changes to the Statewide educational data processing master plan.

e. Provide field services to the regional centers.

3. Center Roles in the Design of New Applications

a. Role of the Evaluation and Training Centers

Obviously, the Statewide educational data processing system cannot be a static system, but must react to changes in the needs of the districts, as well as to changes brought about by state and national data requirements. The availability of new types of equipment and processing techniques must also be considered for impact upon the system. In any case, the kinds of activities that will be discussed in this section are those concerned with new application design and checkout, and are not related to the basic system implementation.

Due to the special skills and extra machine capability available at the E/T centers, these centers will have the major role in designing and testing new applications to be utilized in the Statewide system. It is anticipated that at least two of the staff at each of the E/T centers will be concentrating on improving the existing system packages and designing new applications. The NYSEDS Coordinator will need to closely supervise this new development activity, however, to prevent unwanted duplication of effort at the E/T centers. After improvements in old applications, or designs of new applications, are thoroughly checked out under operational conditions, the resultant program packages will be forwarded to the other regional centers for inclusion into the Statewide system.

b. Role of the Regional Centers

The first task to be performed by the regional center system analysts and programmers will be to make minor revisions in the system packages, as required by "local conditions." Local conditions are those factors, at the district level, which make it necessary to accomplish certain minor revisions in programs in order to get the districts to join the system. These revisions must be minor, however, or the effectiveness of the Statewide system will be seriously degraded.

What will the system analysts and programmers do after the system is completely operational? This question has arisen repeatedly and will be answered herewith. In the presently envisioned system, it is expected that the regional center staff will be involved with the following developmental activities:

1) Implementing new applications designed and checked out at the E/T Centers.

2) Designing new applications suggested by local needs.

Creativity should be encouraged and utilized whenever it appears in the State. If regional center personnel get an idea for a new and useful application, they should be allowed to develop it. The number and kinds of new applications being developed at the regional level, however, will have to be carefully coordinated to prevent duplication of effort and wasted activity. It is suggested that such development activity be approved by the E/T center serving the area. Once the application is completed, it should also be evaluated by the area E/T center as to whether it should be included in the system package.

The Statewide coordinator should insure that there is no unwanted duplication in new application development across the State.

3) Developing special purpose one time applications to meet local requirements.

The kinds of programs anticipated here are special applications, requested by one or more districts in the region, which are considered feasible by the center staff. These activities may include special inventories, listings, analyses of student data, etc. It should be remembered, however, that the regional centers are primarily production facilities and their first duty is always to get the normal reports out on time. New development activity, therefore, can only be accomplished when time is available.

B. RURAL SUPPLEMENTARY EDUCATIONAL CENTER - A Case Study

An ESEA Title III funded project in the rural Catskill Mountain area of New York is a good illustration of the opportunities and problems associated with the introduction of instructional technology. (See attached description of the project).

The project area in Delaware County consists of a number of small, relatively isolated school districts. Frank Cyr, a retired Teachers College professor long interested in the problems of rural education, conceived the idea of using television, telephone and other media to bring better education to these isolated communities. He won the support of local educators and community leaders, with an assist from a local philanthropist who offered to donate a building and land for the project.

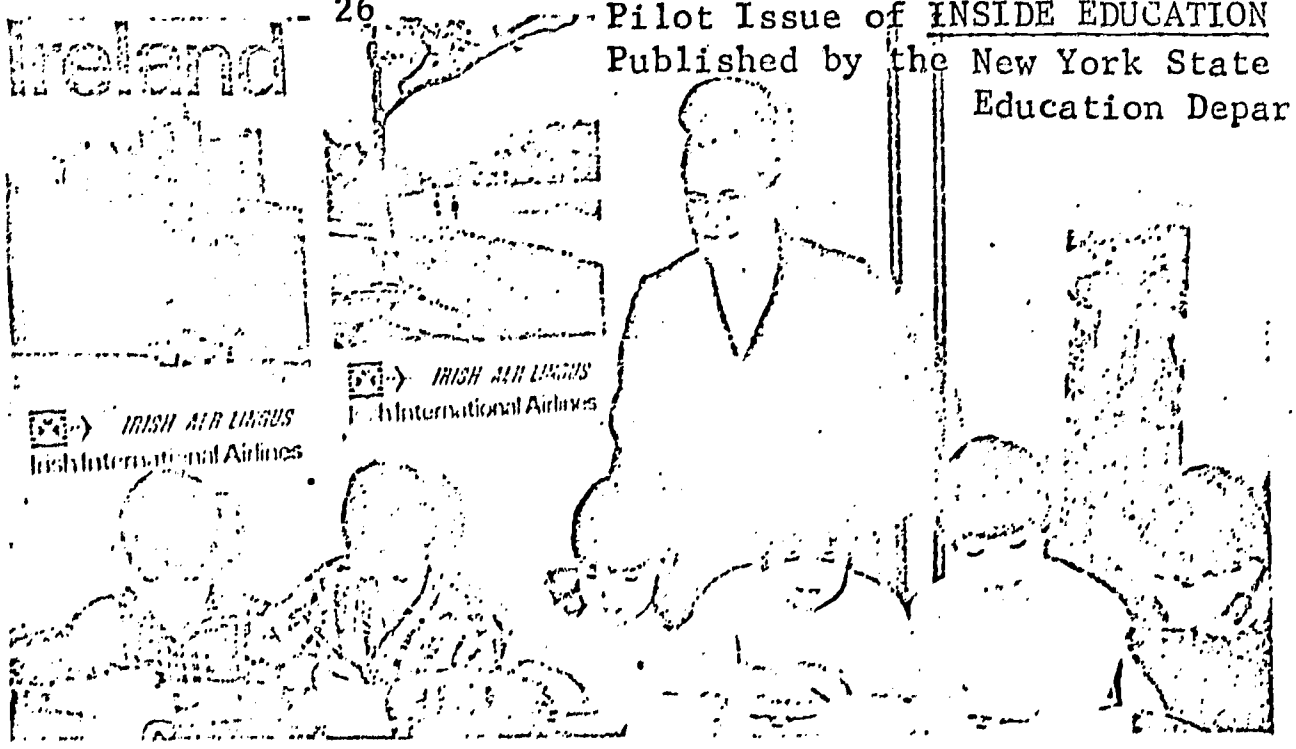
The next step was a request for a Title III grant prepared for the first competition when the program was new and policy guidelines not established. The proposal immediately posed the first issue - cost. The request was for over $900,000 for a project to serve a relatively small number of pupils. It also included considerable funds for equipment, which many thought should not be the emphasis for Title III. However, the project was addressed to a problem that existed in every sparsely settled mountainous region of the State and Nation. If the project were to be successful it offered a solution to the need for equalizing educational opportunity for thousands of rural youth.

After much consultation between State and Federal officials, therefore, the project was funded by the U. S. Office of Education at a lower figure than requested but still higher than the State Education Department, it must be confessed, wanted to go to start.

An unusual program headquartered in Delaware County is helping to improve education in sparsely populated areas of New York State by stimulating educators to use all available means of communication to reach both students and the public.

Known as the Rural Supplementary Educational Center (RSEC), the project was set up to provide facilities to expand and improve educational and cultural opportunities in the rural schools and communities of Greene, Delaware, Otsego, and Schoharie counties, according to project director Frank Cyr.

The mountainous area served by the Center is located at the headwaters of the Delaware, Susquehanna, and Schoharie rivers and consists of 21 autonomous school districts in an area about 30 by 100 miles. The largest village in the district has a population of just over 1,200, and the total population of the area is approximately 56,000. The communities are small and scattered throughout the valleys of the area.




TELE-LEARNING is one means of expanding the educational opportunities of the rural schools served by the RSEC in Stamford, N.Y. Shown above is Mrs. Cleora Hughes, coordinator of tele-learning and cultural resources, assisting a group of area children in placing a call.

### To Assist Schools

The major function of the RSEC, Frank Cyr, is to assist schools and communities in the use of multi-communications for improving educational opportunities. This includes finding out what teachers want and continually seeking resources to meet these needs, and also providing assistance to teachers, pupils, and others in the use of new communications.

The RSEC was organized in January 1966 with the support of Title III of the Elementary and Secondary Education Act. It now has a professional staff of 12 and a para-professional staff of 19 employees, some on a part-time basis. This includes an aide at each school to assist local teachers in the use of services.

The small size of the Center's staff requires the performance of a wide variety of functions on a small scale by each staff member, Cyr points out. Therefore, personnel must each have more than one area of competency. The highly specialized departments, with highly specialized personnel, which are basic to large scale operations are not adapted to the rural situation, Cyr says, where the work load could not make full use of such personnel. "Here the local personnel must be competent in those skills which are required day by day, while highly specialized personnel are employed as needed for short periods and often by use of telephone conferences."

**Provision of multi-communications is the primary purpose of RSEC. This gives each teacher an opportunity to choose the means of presenting ideas which best suit his purposes. He is not limited to any one means of instruction.**

For example, the RSEC distributes books, microfilm, films, filmstrips, records, slides, transparencies, study kits, and other instructional materials to participating schools. At the request of teachers, these materials are circulated among the schools in a mobile van which makes twice-weekly visits to each school.

Exhibits of original paintings and sculpture with a total valuation of more than $70,000 have been circulated annually among the schools and to the public.

### Tele-Learning Circuit

A unique Tele-Learning circuit among the participating schools has a central switchboard at the RSEC office and amplified transmitters and speakers in each school. A group of pupils or adults in their own schools can carry on a two-way discussion with similar groups in the other schools or with resource persons anywhere in this country or abroad where they can be reached by telephone.

In addition to a wide variety of resource people, pupils have carried on discussions with other pupils in four foreign countries. "The purpose of these calls is to motivate pupils and enrich the curriculum," says Cyr.

An educational television system operated by the Center is able to receive, record, and broadcast programs from four ETV stations. The system can also use prepared videotapes or films, or can produce programs indigenous to the rural area which it serves. By using videotape recorders and UHF translator towers on six mountaintops in the area, programs are carried into schools and homes directly and through seven small village CATV systems where these are available.

### Schools Are Wired

Each participating school is wired with coaxial cable and has equipment to monitor and record programs for use either directly off the air or for later use at the convenience of the teacher. The schools are also able to produce local videotapes of school and community activities.

Many of the district's high school students have been trained to operate the school's television equipment. "In this rural area," says Cyr, "where the chief means of earning a living is either in agriculture or in small, electrically powered industries, this practical training in television operation provides a skill not usually available to students."

Then the problems started. The central feature of the project was to be the construction of a television antenna on the highest peak in the region to enable reception of ETV programs from four stations outside the region (Schenectady, Syracuse, Binghamton and New York) and the transmission of programs directly to the schools within range of the antenna. It turned out that an FCC license was required which, for a variety of reasons, was not routinely granted. It took nearly a year and a half of diligent effort by Dr. Cyr to get the license. It is doubtful if anyone with less experience and influence could have done this; and, without the license, the heart would have been taken out of the project.

The next set of problems arose from the fact that no one had experience with the design and construction of the kind of system called for. There were companies capable of installing the antenna, others ready to do the studio; other ready to lay the cable, but none that were immediately ready and experienced enough to take on the entire job. Finally a contractor was found; but lack of experience produced delays and problems that may well have discouraged a less determined group.

To provide the participating schools with services while the television system was being readied a telelearning network was established in cooperation with the local telephone company. Groups in several locations have "met" together and specialists and interesting individuals have been brought into the classrooms of the region.

Finally in the second half of the 1967-68 school year the television system began to work. A wide variety of programs off air and from tape are now bring brought into the schools. Teachers are learning how to use this resource and the community is beginning to understand what it can do for its children.

Now comes the critical problem. Federal support, which will have amounted in all to about $1¼ million is about to terminate. The basic capital equipment has been acquired but the continuing operating costs are still high. The participating communities are not wealthy; school costs have been going up rapidly and, with active teacher negotiation just reaching the region, are certain to go up more next year.

While the project has thus far seemed to be successful it has not been in operation long enough either for the teachers and administrators to realize and use its full potential or for the taxpayers to be convinced of its worth. When faced with the need to cut back, people prefer to cut the new and not fully tried, even if it has great future potential, then to drop practices of long-standing even if they are no longer contributing in proportion to their cost.

The local administrators are, therefore, convinced that the project cannot be continued unless support from Federal, State or other outside source is forthcoming. The participating districts have put up $60,000 currently to help support the telelearning network and they are ready to add to this amount next year, but not to the extent necessary to sustain the project. This comes at a time when Federal and State funds are also greatly restricted.

A further complication results from the fact that in New York State school aid is paid on a cost reimbursable basis. Expenditures made in one year are reimbursed at the district's aid ratio in the following year. Thus when a district adopts a new program it must pay the full costs the first year and is reimbursed the following year. Federal funds used to support a project are not reimbursable. In the present case, the

participating districts would have to put up the whole cost in the first year of local support even though they will be reimbursed for as much as 90% the next year. This is a difficult burden. The State is exploring ways of overcoming this difficulty.

At the time of writing the fate of the project is uncertain. What is needed in this situation, and undoubtedly in the many others of similar nature, is a detailed cost-benefit analysis of the entire system. While the project budget appears large when presented as a single item ($180,000), it represents only 1.07% of the total operating budgets of the schools in the area.

If the local taxpayer could be shown what the costs and benefits are of other major segments of the educational system, it might be possible to show him activities that could be dropped with little loss in exchange for the benefits of the new program.

Alternatively, it may be possible to show that some things now being done could be done equally well or better with the aid of the new arrangements so that with little or no increase in outlay both new and old services could be supplied. Until such analysis is available one cannot blame the layman or the educator for preferring activities that time has proved to be "necessities" to activities that the system survived without until only a short time ago.

Still another alternative is to continue outside support long enough to demonstrate that the new services are as much "necessities" as the old. Given long enough to discover what technological aides can do for them, teachers and taxpayers will demand and pay for them.

## E. NEW YORK CITY COMPUTER ASSISTED INSTRUCTION PROJECT -

### A Case Study

Another ESEA Title III project illustrates other problems in the introduction of instructional technology. A grant was made to the New York City Board of Education to enable it to contract with RCA for the introduction of a computer-assisted instruction system developed by Professor Patrick Suppes of Stanford University.

The project provided for the installation of some 200 terminals in about 15 different school buildings throughout the City, all linked by telephone line to a central computer. The instruction to be offered was drill and practice lessons in arithmetic and language arts in the elementary grades. About 6,000 pupils would be served, each spending about twenty minutes per day at the terminal.

Again initial costs were high in relation to the apparent immediate benefits and in comparison with other school costs. It was the potential represented by the project that led to its funding. The fiscal problems associated with assumption of local support may follow that described previously when Federal funds are terminated.

The additional problems illustrated by this project have to do with the introduction of change in a large school system.

There was first the task of working out a contract that satisfied all of the legal and fiscal requirements of the Board of Education and the City and was satisfactory to the U. S. Office of Education. This involved extended negotiation between RCA and the offices involved.

Then specific schools had to be identified in which the terminals would be placed. A number of local superintendents and building superintendents and building principals to whom the opportunity to participate

was offered declined. Reasons given largely were that they had too many other problems to be bothered with this new idea. Finally, with assistance from the Superintendent of Schools, fifteen suitable sites were selected.

Next, the school building department had to be contended with. To install the terminals required some minor alterations and the installation of electrical and telephone outlets. To get approval for this work and its completion on time involved another series of confrontations with bureaucracy.

Still another set of offices had to be cajoled into expediting procedures when it came to finding space for the computer. School space never was found and this difficulty was only overcome when RCA agreed to lease commercial space itself.

The next series of problems involved the Telephone Company. It turned out that in the private sector, too, assurances of full support and cooperation from the top did not mean much at the operating levels. Equipment delivery and installation was slow. It was exceedingly difficult to get operating problems attended to. Furthermore, three different operating units were involved in the three boroughs in which the schools were located. It proved difficult to get them to work together to resolve problems arising from the need to connect their three systems.

Finally, the problems attendant on keeping the system operating continuously have proved formidable. When failure occurs, the problem may be at the terminal; it may be in buffer equipment in the schools; it may be in the telephone lines; it may be in the data-phone connection; it may be at the central installation or in the computer; it may be in the software; or, worst of all, it may be in some combination of all of these. All of these problems

have occurred. When the system goes "down" pupils, teachers and project personnel are all frustrated. Fortunately the limits of this frustration have not yet been reached. It is hoped that the system is stabilized before the limits are reached and the school system decides to reject the idea.

It should be noted that all of the problems so far described have to do with the hardware side of the project. The instructional materials will undoubtedly present their own set of problems, but these will not become apparent until there has been more experience with a fully operating system.

This experience indicates the kind of practical problems that are going to have to be met if educational technology of any complexity is going to be introduced on any significant scale into American schools.